

# Ecological Impacts of Invasive Species

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## Background

Nealy 6,500 nonnative species are responsible for the extinction of hundreds of native species in the United States<sup>1</sup>. The introduction of invasive species is ongoing and the ecological ramifications of these invasions are diverse, but could include competition between invasive and native species, disruption of natural ecological processes, and reduced ecosystem services. While invasive species are able to severely damage vital ecosystems, there are methods of predicting and lessening the impacts.

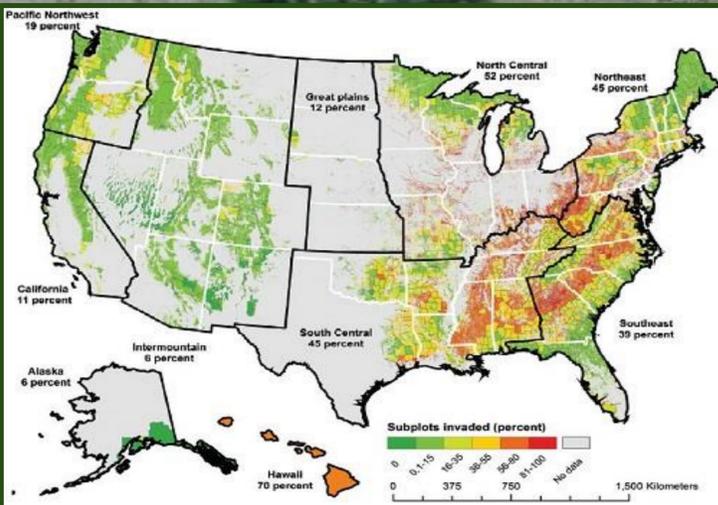


Figure 1. Map of invasions of non-native species in the United States as of 2016. Note that coastal areas are invaded more commonly due to water transportation. In addition, tropical areas have a higher percentage of invader abundance, suggesting that those areas better suited to invaders<sup>2</sup>.

## Objectives

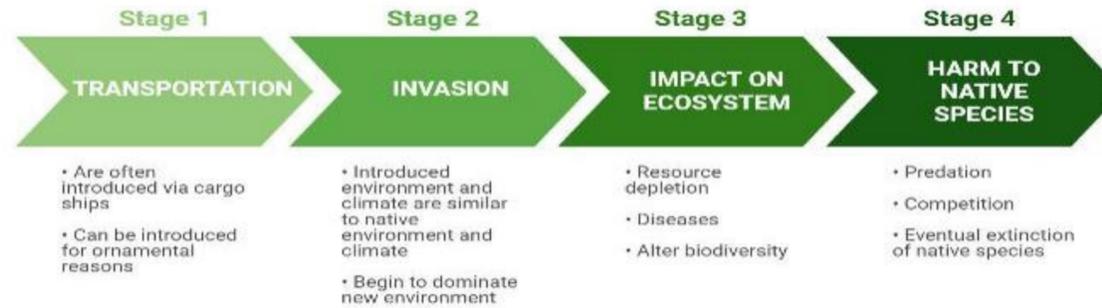
The purpose of our study is to:

- Demonstrate how invasive species have a negative influence on ecosystems
- Educate the public about the dangers of invasive species spreading if not controlled or monitored
- Illustrate how different model designs can be beneficial to inhibiting future invasions and providing early detection

## Methods

**Key words:** Native species, competition, invasive species prevention, detection

We conducted an extensive literature review to examine how invasive species are controlled and managed, and how current preventative measures can be improved upon.



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Figure 2. Introduction pathway of non-native species to an ecosystem.

## Results

Invasive Species					
	<i>Emerald Ash Borer</i> <i>Agilus planipennis</i>	<i>Eurasian Carp</i> <i>Cyprinus carpio</i>	<i>Purple Loosestrife</i> <i>Lythrum salicaria</i>	<i>Wild boar</i> <i>Sus scrofa</i>	<i>Burmese Python</i> <i>Python bivittatus</i>
Origin & Introduction to the United States	Origin: China Introduced: transported by wood carried on cargo ships	Origin: Southern China/eastern Russia Introduced: used to control algae and weeds in aquatic farms/canals; escaped into Mississippi River	Origin: Asia & Europe Introduced: transported through ballast water and importation of seeds	Origin: Eurasia & North Africa Introduced: bought over for food by settlers and later for sport hunting	Origin: Southeast Asia Introduced: brought over for exotic pet trade; owners released them into wild and some escaped from a destroyed facility
Impacts	Responsible for destruction of tens of millions of ash trees in U.S., destroying habitat of native species and harming economy	Out-compete native fish, lower water quality, rapidly deplete resources which destroyed habitats, & major harm to economy	Displaces native wildlife, eliminating food and shelter for wildlife	Destroy crops, prey on native plant and wildlife, decreases biodiversity, also carries and transmits diseases	Competes with native wildlife, overall decreasing mammal populations
Preventative Measures & Management	<ul style="list-style-type: none"> <li>• Systemic insecticides</li> <li>• Use local firewood</li> </ul>	<ul style="list-style-type: none"> <li>• Barriers</li> <li>• Locks &amp; dams</li> <li>• Commercial fishing tournaments</li> </ul>	<ul style="list-style-type: none"> <li>• Hand pulling small populations (removal of all parts of plant)</li> <li>• Herbicides</li> <li>• Biological control</li> </ul>	<ul style="list-style-type: none"> <li>• Trapping</li> <li>• Recreational hunting</li> <li>• Strategic poisoning</li> </ul>	<ul style="list-style-type: none"> <li>• Trapping</li> <li>• Detection with dogs</li> <li>• Hunting</li> <li>• Burmese python ban</li> </ul>

Figure 3. Invasive species comparison chart. Chart compares several widespread, problematic invasive species in the United States. These invasive species populations have grown exponentially making eradication of them now unlikely. Management plans focus on regulating populations from growing out of control rather than complete eradication. This solution is not ideal and is costly, making early detection and preventative measures important<sup>3,4,5,6,7</sup>.

## Solutions

There are many different solutions to lessening the impacts of invasive species. Each individual circumstance requires a different approach, however, there are some general areas in which improvements can be made:

- Create more inclusive predictive models that provide successful detection rates
- Establish management in early stages of invasions
- Making larger investments in early management of invasive species

## Discussion

There are many ways invasive species are controlled and managed, however, not every approach is adequate. Some are more cost-effective while other models intended for future detection only end up detecting one species and overlook hybrid species. For instance, in one study they used a phenomenological habitat suitability model (HSM), a cost effective approach which relies primarily on environmental variables to predict future ranges for potential invasive species<sup>8</sup>. However, they found that the HSM model was not effective in the detection rate of invasive species. In another study they used DNA sampling to detect the presence of Eurasian carp, which was sufficient, but did not acknowledge hybrid species<sup>9</sup>. Overall, there are not many models that are designed to detect the rate of invasive species for future invasions. This issue has caused ecological harm, depletion of resources, diseases, decrease in native species, and economic harm. Conservationists should anticipate that further management activities are vital, such as re-populating native species or managing the habitat after removal, to reverse ecological damage<sup>10</sup>. In conclusion, our results suggest that urgent improvements are necessary for creating a model that can detect invasive species before their establishment and impact is irreversible.

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Background Image: *Evergreen Forest*. Retrieved 31 March 2022, from <https://sciencewithkids.com/science-facts/facts-about-evergreen-trees.html>.